The last chapter deals with the dominant group of the region, the Bromeliaceae. The 2 main divisions considered are the cistern plants and the epiphytic *Tillandsias*. The latter are divided into those which lean against the support and those having some means of attachment to it. The different adaptations for climbing are illustrated. The structure and function of the hairs of *Tillandsia* and of the hairs on the submerged leaf bases of the cistern species are given particular attention. The presence of cortical roots in the attached lianas is also noted and their value to the plant discussed. Here, as in the Solanaceae, insect pollination is not very common, but the humming bird is a regular visitor to some large-flowered species. A few of the Bromeliaceae, as *Tillandsia usneoides* and *T. recurvata*, have a range from southern United States or Mexico to the southern part of South America. Most of the species mentioned, however, are limited to South America, 9 being given as endemic. The author also includes in this chapter a very interesting description of the xerophytic rupicole species belonging to various families which are found on the rocks of Cerro San Tomas and Sierra d'Acahay.—ARAVILLA TAYLOR.

NOTES FOR STUDENTS

Puget Sound algae.—A fascicle of papers[2] from the Puget Sound Marine Station at Friday Harbor, Washington, gives the results of work done on algae at the station, largely during the summer of 1916.

Miss HURD finds that young bladder kelps (*Nereocystis*) can adapt themselves to 55 per cent of fresh water in their environment if the change is made gradually. She concludes that rapid elongation of this plant is due to low light intensity in the water, and that growth of the stipe is greatly retarded by strong light when the bulb approaches the surface of the water. The fact that this does not act as a very exact determiner of length is readily understood, when we remember that the variation from extreme high tide to extreme low tide during the growing season in this region is more than 12 ft. She reaches the conclusion that there is no relation between rate of growth and mechanical stretching in the stipe of the plant. The experimental evidence given seems to justify this conclusion, providing that nothing else (for example, light) was a limiting factor in both experiment and control.

In another paper Miss HURD decides that the *Codium adhaerens* (Cabr.) Agardh reported from San Juan Islands and probably that from all of Puget Sound is *C. dimorphum* Sved., since it has no utricle hairs and has two types of utricles, the one with unmodified end wall and the other with thickened, striated end wall. She believes that the variation in the predominance of thick or of thin end walls in the utricles is probably due to differences in environment. The thick-walled type sometimes predominates over the whole

[2] Puget Sound Marine Station Publications 1:nos. 17–24. 185–248. *pls. 33–466*. 1916.

thallus, sometimes is found only around the margin and on the under side of the lobes, and sometimes is wanting entirely.

MUENSCHER reports a list of marine algae found on Shaw Island (one of the San Juan group), with notes as to zonal distribution and relative abundance, and a discussion of the ecological factors involved. He finds 54 Rhodophyceae, 31 Phaeophyceae, 15 Chlorophyceae, and 3 Myxophyceae. The plates give the distribution at various points on the island and will be very useful to collectors of algae in the region.

Miss KIBBE reports the presence of a parasitic fungus (*Chytridium alarium*, sp. nov.) on *Alaria fistulosa* collected in Alaska. She examined all of the species of brown algae that were readily available at the Puget Sound Marine Station, and also specimens of *Alaria valida* from Alaska, and did not find any trace of this fungus in any of them. In *A. fistulosa* she found the fungus in various forms in all parts of the plant except the heavy older portions of the stipe.

Miss KARRER finds that some light is thrown on the metabolism of *Nereocystis* by chemical reactions whose results are seen under the microscope. She finds that the cell walls are made up of cellulose and algin, the latter being probably the substance that holds the cells together. She finds that the presence of the inorganic substances (calcium, magnesium, sodium, potassium, chlorine, sulphates, carbonates, phosphates, and iodine) whose presence in the plant have often been shown by analytical chemists can be demonstrated in the cell by using the methods suggested by TUNMANN[3] and MOLISCH[4] with slight modifications.

Miss CLARK reports the acidity of marine algae as determined by titration. She reports that all of the 31 species tested were acid.

LANGDON[5] finds that carbon monoxide is present in the float of the bladder kelp (*Nereocystis*), the quantity varying considerably in different individuals. He finds the presence of carbon dioxide to be only occasional and the quantity minute. He does not find confirmation of previous work tending to show that the quantity of carbon dioxide and of oxygen vary with the time of day. He suggests that since theories of photosynthesis have largely been concerned with carbon monoxide and its reduction product formaldehyde, and with formic acid, of which carbon monoxide may be considered the anhydride, it is possible that the occurrence of carbon monoxide in plant tissues may be more general than has been supposed. Apparently LANGDON'S work is the first demonstration of free carbon monoxide in a living plant. A large plant cavity surrounded by rapidly growing tissue furnishes an unusually favorable opportunity for the investigation of gases taking part in metabolism. The sieve tubes in this plant are in the mycelium-like pith web on the interior surface of

[3] TUNMANN, O., Pflanzenmicrochemie. Berlin. 1913.

[4] MOLISCH, H., Microchemie der Pflanzen. Jena. 1913.

[5] The substance of this paper has also been published in Jour. Amer. Chem. Soc. **39**:149–156. 1917.

the float. Since the whole surface of the sieve tubes in this portion of the plant is thus exposed to the gas contained in this float, it would seem possible that considerable oxidation of foods is carried on in this internal atmosphere. The gas in this float is shown to contain a little larger percentage of oxygen than air. It may possibly be worth while to consider the presence of carbon monoxide in plants in connection with the wide distribution of oxidases in plant tissue and the possible mechanism of their reaction.[6] LANGDON'S thorough demonstration of the presence of carbon monoxide in this cavity is a very important piece of work, and great interest attaches to the possible relation of this gas to the metabolism of the plant.—G. B. RIGG.

Quantitative characters in beans.—By means of a statistical study of pole and bush beans, EMERSON[7] has analyzed the characters causing height variation in *Phaseolus vulgaris*. They are 3 in number and apparently segregate independently after crossing. First is the manner of growth, which is either "determinate" (bush type) or "indeterminate" (pole type), with the indeterminate habit completely dominant in the F_1 generation, and showing the typical 3:1 splitting in the F_2 generation. Such behavior he interprets as the result of a single pair of freely segregating factors behaving in a Mendelian fashion.

TSCHERMAK, using the hybrids *Phaseolus vulgaris*×*P. multiflorus* and the reciprocal, found anomalous splitting in the F_2, since some of the "short" segregates produced "talls" in succeeding generations. He makes no mention of habit of growth, and merely classifies the progenies as "talls" and "shorts." The results of TSCHERMAK need not be compared with EMERSON'S, however, because in the former case the hybrids are interspecific, and in the latter intervarietal (intraspecific).

The second character operative in determining height is number of internodes. The presence of this character was deduced from the fact that different varieties of both pole and bush beans differed in the number of internodes produced when grown under the same conditions. The question then arose as to whether this tendency to produce few or many internodes could be inherited independently of habit of growth. Suitable crosses were made and the results seemed to answer the question in the affirmative, although the evidence is admittedly incomplete. The factors determining this difference could not be shown to be perfectly dominant, but apparent segregation followed hybridization. This segregation was attended in the F_2 generation by a range of variability exceeding that of the 2 parents. EMERSON interprets this result as due to the action of multiple segregating factors.

The third character involved in height is length of internode. The modification of this character by habit of growth made its behavior difficult to study.

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[6] REED, G. B., BOT. GAZ. **62**:53–64. 1916.

[7] EMERSON, R. A., A genetic study of plant height in *Phaseolus vulgaris*. Research Bull. no. 7. Nebr. Agric. Exp. Sta. pp. 73. 1916.